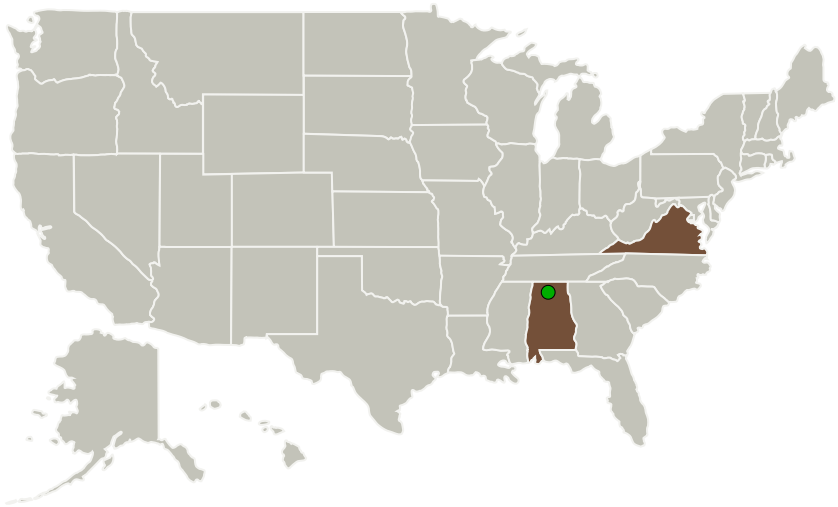
A Low-Cost Method for Coating of Selective Laser Melting (SLM) Manufacturing of Complex High-Precision Components for Spaceflight Applications Using Atomic Layer Deposition (ALD), Phase I

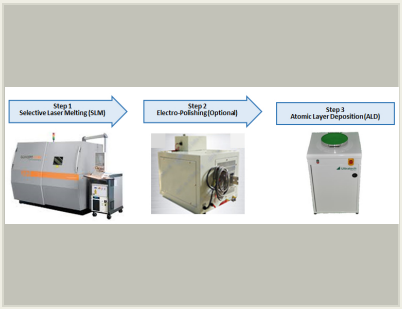
Completed Technology Project (2015 - 2015)

Project Introduction

This proposal is intended to perform basic research using Atomic Layer Deposition (ALD) as a means of coating various substrate materials with a variety of metallic and ceramic oxides for corrosion and thermal protection. In particular, due to growing interest in significant cost-reduction using the technology of Selective Laser Melting (SLM), this proposal will attempt to develop a state-of-the-art and low-cost method of polishing and coating a sub-scale thruster nozzle modeled after the ALCOT Thruster and built using SLM. SLM has shown the potential to reduce production costs by 70% or more. By combining SLM with the process of electro-polishing and application of uniform thin-film coatings using ALD, we believe that we can develop a complete manufacturing process by-which high-precision, complex and here-to-fore costly components can be produced at a fraction of their current cost. We intend to demonstrate a method of coating stainless steel, Tungsten and ultimately a Tungsten/Titanium Carbide (W/TiC) matrix created via SLM with Iridium Oxide (IrO2 or IrO3) in Phase I and Yittria-stabilized zirconia (YSZ: Y2O3-ZrO2) and Yittria (Y2O3) in Phase II. This proposal will be a demonstration of smoothing and coating several different substrate materials with a variety of oxides in Phase I which appear to offer significant benefits to the low-cost manufacture of material components of great interest to NASA.

Primary U.S. Work Locations and Key Partners





A Low-Cost Method for Coating of Selective Laser Melting (SLM) Manufacturing of Complex High-Precision Components for Spaceflight Applications Using Atomic Layer Deposition (ALD), Phase I

Table of Contents

A Low-Cost Method for Coating of Selective Laser Melting (SLM) Manufacturing of Complex High-Precision Components for Spaceflight Applications Using Atomic Layer Deposition (ALD), Phase I

Completed Technology Project (2015 - 2015)

Organizations Performing Work	Role	Type	Location
Summit Information Solutions, Inc.	Lead Organization	Industry Women-Owned Small Business (WOSB)	Glen Allen, Virginia
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Virginia

Project Transitions

June 2015: Project Start

December 2015: Closed out

Closeout Summary: A Low-Cost Method for Coating of Selective Laser Melting (SLM) Manufacturing of Complex High-Precision Components for Spaceflight App lications Using Atomic Layer Deposition (ALD), Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/138732)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Summit Information Solutions, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

James C Bradas

A Low-Cost Method for Coating of Selective Laser Melting (SLM) Manufacturing of Complex High-Precision Components for Spaceflight Applications Using Atomic Layer Deposition (ALD), Phase I

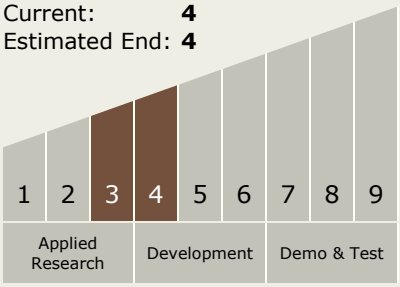
Completed Technology Project (2015 - 2015)

Images

Briefing Chart Image
A Low-Cost Method for Coating of Selective Laser Melting (SLM) Manufacturing of Complex High-Precision Components for Spaceflight Applications Using Atomic Layer Deposition (ALD), Phase I
(https://techport.nasa.gov/image/129313)

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.2 Structures
    - TX12.2.5 Innovative, Multifunctional Concepts

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System